

Floristic diversity of Laokhowa wildlife sanctuary, Assam, India

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भारत के लाओखोवा वन्यजीव अभयारण्य, असम की पुष्पीय पादप विविधता

छाया देउरी व एस. आर. तालुकदार

सारांश

इस शोध पत्र में लाओखोवा वन्यजीव अभयारण्य का पुष्पीय पादप विवरण है, जिसमें 303 वंश के 409 टैक्सा एवं आवृतबीजी व पर्णांग के 105 कुल शामिल हैं। इनमें द्विबीजपत्रीय पादपों की 281 जातियां, 01 उपजाति, 3 प्रभेद और एकबीजपत्री पादपों की 104 जातियां हैं, जबकि पर्णांगों की 20 जातियां शामिल हैं। यहाँ 266 जड़ी बूटी जातियां, 49 वृक्ष, 63 क्षुप और लघु क्षुपों की 31 जातियां हैं। यहां प्राकृतवास के आधार पर 351 पादप स्थलीय, 09 अधिपादप, 45 जलीय और 04 परजीवी पौधे हैं। प्रस्तुत शोधपत्र में अभयारण्य की वनस्पति का संक्षिप्त विवरण, पौधों की आर्थिक उपयोगिता और संरक्षण उपायों का विवरण दिया गया है।

ABSTRACT

The paper provides a floristic account of Laokhowa Wildlife Sanctuary which includes 409 taxa belonging to 303 genera and 105 families of Angiosperms and Pteridophytes. The dicotyledons are represented by 281 species, 1 subspecies, 3 varieties, monocotyledons are with 104 species; while pteridophytes with 20 species. There are 266 herbaceous species, 49 trees, 63 shrubs and 31 under shrubs. Habitats wise, there are 351 species of terrestrial, 9 epiphytes, 45 aquatic and 4 parasites. A brief account of vegetation of the sanctuary, economic potential of plants, threats and conservation measures have been provided.

Keywords: Floristic diversity, Laokhowa Wildlife Sanctuary, Vegetation, Assam, Economic potential, Conservation.

INTRODUCTION

Laokhowa wildlife sanctuary is located in the central Assam near the southern bank of River Brahmaputra in Nagaon district of Assam (26°30'N to 26°32'N Latitude and 92°40'E to 92°47'E Longitude). The sanctuary covers an area of 70.13 sq. km. and has a common boundary with Burachapori Wildlife Sanctuary (Fig. 1). The

sanctuary has a proud legacy of being a protected area for over 110 years. The sanctuary was first identified and demarked by the colonial British Government as a game Reserve in 1907 and declared as a wildlife sanctuary in 1972. Before 1983 the sanctuary was the natural home for large populations of one horned *Rhinoceros unicornis* which was severely affected during subsequent years and presently the sanctuary is devoid of even a single Rhino.

Many other wild animals such as *Asiatic Elephant*, *Wild Buffalo*, *Hog deer*, *Barking deer*, *Tiger*, *Leopard*, *Civets*, *Wild pig* are found in the sanctuary. A good number of both local and migratory birds, endemic species of fishes, various amphibian species, reptiles and several species of butterflies are also found here. The sanctuary being a flood plain of the river Brahmaputra, its ecosystem is a unique; combination of grassland, wetland and different riparian forest types (Nath, 2012; 2012a; Nath & Sarma, 2012). However, the sanctuary is facing grave threats in the form of encroachment of sanctuary land for cultivation, dwelling, community grazing ground, domestication cattle and felling of timber and firewood value plants. No authentic information on plants of the sanctuary is available except Hooker, 1875-1897; Kanjilal & al., 1934-40 and Chowdhery & al., 2005. In the present work an attempt was made to analyze the vegetation and plant composition of the sanctuary particularly emphasizing the native plants and economic potential of plants, threats and conservation measures.

CLIMATE

The climate of the sanctuary is typical monsoonal and remains highly warm and humid throughout the year.

The region receives rain during summer due to early commencement of south-west monsoon with an average of 250-300 cm and winters are usually cold and dry. The maximum temperature attained during the summer is 26°-34°C and minimum during the winter is 8°-15°C.

MATERIALS AND METHOD

The study on the flora of the Laokhowa Wildlife Sanctuary was carried out from April 2013 to March 2016. Four field tours were conducted in the four different seasons of the year and collected 635 voucher specimens along with GPS co-ordinations and colour photographs. All the collected plant specimens were identified with the help of relevant literatures (Hooker, 1875-1897; Kanjilal & al., 1934-40 and Chowdhery & al., 2005) and with consultation with herbarium specimens housed in ASSAM. All the earlier collections from the sanctuary lodged at ASSAM has also been studied.

OBSERVATIONS

Following forest types are observed in the sanctuary:

Scrub Forests: This type of forest is mainly found in northern side of the sanctuary. The main dominant

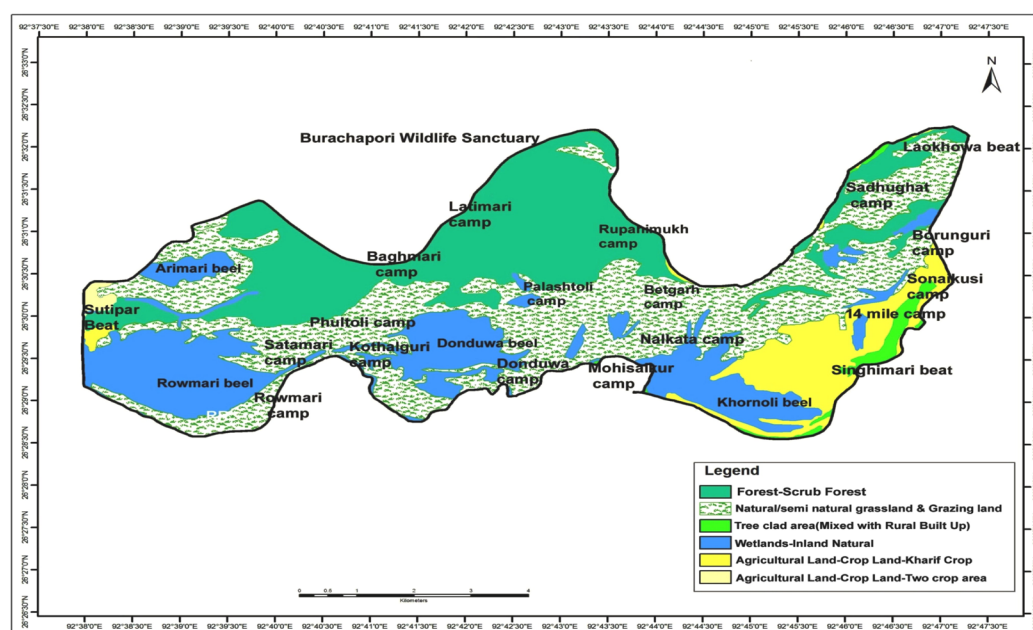


Fig. 1: Map of Laokhowa Wild life sanctuary.

(Source: North Eastern Space Applications Centre, Umiam, Ri- Bhoi District, Meghalaya.)

species are *Ardisia humilis*, *A. icara*, *A. paniculata*, *A. solanacea*, *Caesalpinia bonduc*, *C. cucullata*, *Casearia vareca*, *Clerodendrum cordatum*, *C. indicum*, *C. japonicum*, *Combretum wallichii* var. *flagrocarpum*, *Embelia tsjeriam-cottam*, *Flemingia strobilifera*, *Glycosmis pentaphylla*, *Grewia laevigata*, *Leea asiatica*, *Marsdenia tenacissima*, *Mussaenda roxburghii*, *Psychotria montana*, *Senna occidentalis*, *S. oxyphylla*, *Thevetia neriifolia*, *Uncaria sessilifructus* etc. The climbers and scandent lianas are mainly *Aganopethyrsiflora*, *Asparagus racemosus*, *Cissus adnata*, *Clematis cadmia*, *Cissampelos pareira*, *Coccinia grandis*, *Dioscorea bulbifera*, *Ichnocarpus frutescens*, *Ipomoea cheirophylla*, *I. obscura*, *Lygodium japonicum*, *L. flexuosum*, *Momordica dioica*, *Mucuna pruriens*, *Passiflora foetida*, *Stephania japonica*, *Smilax ovalifolia*, *Tetrastigma angustifolium* etc. The herbaceous vegetation mainly composed of *Achyranthes aspera*, *Adenostemma lavenia*, *Alocasia fornicata*, *Carex hebecarpa*, *Cheilocostus speciosus*, *Colocasia esculenta*, *Commelina benghalensis*, *Desmodium triflorum*, *Murdannia nudiflora*, *Persicaria chinensis*, *Zingiber rubens* etc. Species belonging to the families Lamiaceae, Scrophulariaceae, Capparaceae, Cannabaceae were also seen growing. The terrestrial ferns like *Cyclosorus aridus*, *C. tylodes*, *Diplazium dilatatum*, *D. esculentum*, *Helminthostachys zeylanica*, *Thelypteris esquirolii* etc., and a lone ground orchid *Zeuxine nervosa* was found.

Barringtonia swamp forest: This type of forest occurs in the low-lying areas which remains inundated during the rainy season. This type of forest is mainly composed of *Barringtonia acutangula* and sparsely *Bischofia javanica*, *Bombax ceiba*, *Butea monosperma*, *Bridelia retusa*, *Cratogeomomura*, *Derris cuneifolia*, *Erythrina fusca*, *Glochidion coccineum*, *Streblus asper* etc. The ground vegetation is seasonally dominated by *Carex hebecarpa*, *Ficus heterophylla*, *Potentilla indica* and patches of *Calamus tenuis*, *Eichhornia crassipes*, *Ludwigia adscendens*, *Lasia spinosa* etc. Epiphytes mainly orchids and ferns like *Gastrochilus obliquus*, *Papilionanthe teres*, *Rhynchostylis retusa*, *Lemnaphyllum microphyllum*, *Pseudodrynaria coronans*, *Pyrrosia lanceolata* etc., are found.

The Grassland and Savannah Grassland: This type of vegetation is concentrated in the central part of the sanctuary. The ground vegetation of the grasslands composed of *Acroceras zizanioides*, *Axonopus compressus*, *Chrysopogon aciculatus*, *C. zizanioides*, *Cynodon dactylon*, *Dactyloctenium scindicum*, *Eleusine indica*, *Imperata cylindrica*, *Paspalidium flavidum* etc., and sparsely growth of *Melilotus indicus* are seen. Apart from the above grasses

the Savannah grasslands are composed of tree species like *Barringtonia acutangula*, *Bombax ceiba*, *Ficus lamponga*, *Ilex khasiana*, *Ziziphus jujuba* etc., and some shrubs like *Flemingia strobilifera*, *Ricinus communis* etc., are found.

Tree Clad area or Plantation forest is mainly concentrated in the north-east part of the sanctuary. These areas are mainly composed of *Albizia procera* plantation and some trees of *Alstonia scholaris*, *Bombax ceiba*, *Delonix regia*, *Erythrina fusca*, *Lagerstroemia speciosa*, *Mallotus nudiflorus*, *M. philippensis*, *M. repandus*, *Moringa oleifera* etc., are seen. The ground vegetation is dominated by *Floscopa scandens*, *Gnaphalium purpureum*, *Grangea maderaspatana*, *Hydrolea zeylanica*, *Impatiens tripetala*, *Lasia spinosa*, *Mimosa pudica*, *Oldenlandia corymbosa* etc.

The wetland vegetation is mainly concentrated in the low-lying water filled areas of the Sanctuary. These areas are concentrated of wetland flora with aquatic macrophytic species. The aquatic macrophytic plants are composed of (1). Pure aquatic macrophytes and (2). Semi-aquatic macrophytes. The pure aquatic macrophytes can be classified into various sub groups based on the state of growth in their habitats such as **a.** Free floating aquatic macrophytes (*Azolla pinnata*, *Eichhornia crassipes*, *Hydrocharis dubia*, *Lemna perpusilla*, *Pistia stratiotes*, *Salvinia cucullata*, *Trapa natans*, *Utricularia aurea* etc.); **b.** Free submerged aquatic macrophytes (*Ceratophyllum demersum* etc.); **c.** Anchored floating aquatic macrophytes (*Euryale ferox*, *Hygroryza aristata*, *Ipomoea aquatica*, *Nelumbo nucifera*, *Nymphaea nouchali*, *Nymphaea rubra*, *Nymphoides cristata*, *Nymphoides indica* etc.) and **d.** Anchored submerged aquatic macrophytes (*Hydrilla verticillata*, *Ottelia alismoides*, *Potamogeton crispus*, *Potamogeton octandrus*, *Vallisneria spiralis* etc.).

The semi aquatic macrophytes are *Achyranthes aspera*, *Alternanthera philoxeroides*, *Alternanthera pungens*, *Amaranthus spinosus*, *Amaranthus viridis*, *Ammannia baccifera*, *Axonopus compressus*, *Bacopa monnierioides*, *Cenchrus americanus*, *Centella asiatica*, *Coix lacryma-jobi*, *Commelina appendiculata*, *Commelina benghalensis*, *Commelina sikkimensis*, *Cucumis melo*, *Cuphea carthagenensis*, *Cynodon dactylon*, *Cyperus compressus*, *C. iria*, *C. platystylis*, *C. rotundus*, *C. tenuispica*, *Dactyloctenium scindicum*, *Eclipta prostrata*, *Enydra fluctuans*, *Eragrostis unioides*, *Fimbristylis dichotoma*, *F. squarrosa*, *Ipomoea carnea*, *Isachne clarkei*, *Ludwigia adscendens*, *L. hyssopifolia*, *L. octovalvis*, *Merremia umbellata*, *Mollugo pentaphylla*, *Murdannia nudiflora*, *Nelsonia canescens*, *Nicotiana plumbaginifolia*,

Oxalis corniculata, *Panicum paludosum*, *Paspalidium punctatum*, *Paspalum scrobiculatum*, *Persicaria hydropiper*, *P. orientalis*, *Phragmites karka*, *Phyla nodiflora*, *Polygonum plebeium*, *Polytoca digitata*, *Pouzolzia hirta*, *Rotala rotundifolia*, *Rumex nepalensis*, *Rungia pectinata*, *Schoenoplectiella articulata*, *S. erecta*, *Stenosieris graciliflora*, *Xanthium strumarium* etc. (Talukdar & Deori, 2016)

Table 1: Statistical synopsis of flora of Laokhowa Wildlife Sanctuary, Assam

Taxonomic Group	Families	Genera	Species	Varieties/ Subspecies
Pterido-phytes	12	17	20(5%)	
Dicotyledons	76	218	281(70%)	1sub-species, 3varieties
Monocotyledons	17	68	104(25%)	
Total	105	303	405	4

Table 2: Dominant families of Laokhowa Wildlife Sanctuary

Sl. No.	Families	Genera	Species
1	Poaceae	28	38
2	Fabaceae	16	23
3	Cyperaceae	6	23
4	Asteraceae	20	20 (1var.)
5	Euphorbiaceae	12	19
6	Solanaceae	5	10
7	Cucurbitaceae	7	9
8	Caesalpiniaceae	5	9
9	Polygonaceae	3	9
10	Commelinaceae	3	8

Floristic analysis and life forms

The study on the flora of Laokhowa Wildlife Sanctuary revealed occurrence of 405 species, 1 subspecies, 3 varieties belonging 303 genera and 105 families of Angiosperms and Pteridophytes. The Angiosperms consist of 385 species, 1 subspecies 3 varieties distributed in 286 genera and 93 families, of which the dicots represented by 281 species, 1 subspecies, 3 varieties and monocot by 104 species. The Pteridophytes comprise of 20 species, belonging to 17 genera and 12 families. The most dominant family is Poaceae with 38 species which is followed by Fabaceae, Cyperaceae, (23 Species) each, Asteraceae, (20 species) and Euphorbiaceae (19 species) etc. Table 2 shows the first 10 dominated families in the sanctuary. The study revealed occurrence of 266 maximum herbaceous species 49 trees, 63 shrubs and 31 under shrubs. Occurrence of maximum herbaceous species is due to high anthropogenic disturbance in the sanctuary (Talukdar & Deori, 2016 a).

Threats

The floristic composition and fauna of Laokhowa Wildlife Sanctuary is facing major threats due to biotic and abiotic factors. The vegetation and floristic composition is being negatively influenced due to extraction of firewood and timber by villagers surrounding the sanctuary. Encroachment of forest land by developing agriculture land in the surrounding regions affects the floristic composition of the vegetation and the habitat of wild animals residing in the region. Various invasive species or weeds such as *Ageratum conyzoides*, *Annona reticulata*, *Eichhornia crassipes*, *Mimosa pudica*, *Physalis minima*, *Ricinus communis*, *Zephyranthes minima* etc., imparts threat to the growth and propagation of the native species of the sanctuary. Moreover the massive soil erosion during the

Table 3: Analysis of different life forms of Angiosperms and Pteridophytes in Laokhowa Wildlife Sanctuary, Assam

Trees 49 (12%)		Shrubs 63(15%)		Herbs 266(65%)						Under shrubs 31(8%)	
Terrestrial	Climbers	Parasite	Aquatic	Terrestrial	Climbers	Epiphytes	Terrestrial	Aquatic	Parasite	Terrestrial	Aquatic
49	17	3	1	42 (1var.)	37	9	177 (177sp., 2 sub sp.2 var)	42	1	29	2



Plate 1: A. Swampy forest area in Laokhowa Wildlife sanctuary, B. Patches of *Barringtonia acutangula* (L.) Gaertn. in grassland vegetation, C. Secondary forest, D. Vigorous growth of *Nelumbo nucifera* in the wetlands, E. Grassland vegetation, F. Savannah grassland vegetation, G. Encroachment of portions of wetlands of Laokhowa Wildlife Sanctuary for cultivation and dwelling, H. Uprooting of trees by wild elephant inside the Laokhowa Wildlife Sanctuary, I. *Helminthostachys zeylanica* (L.) Hook, J. *Ceratopteris thalictroides* (L.) Ad. Brongn., K. *Cajanus scarabaeoides* (L.) Graham ex Wall.

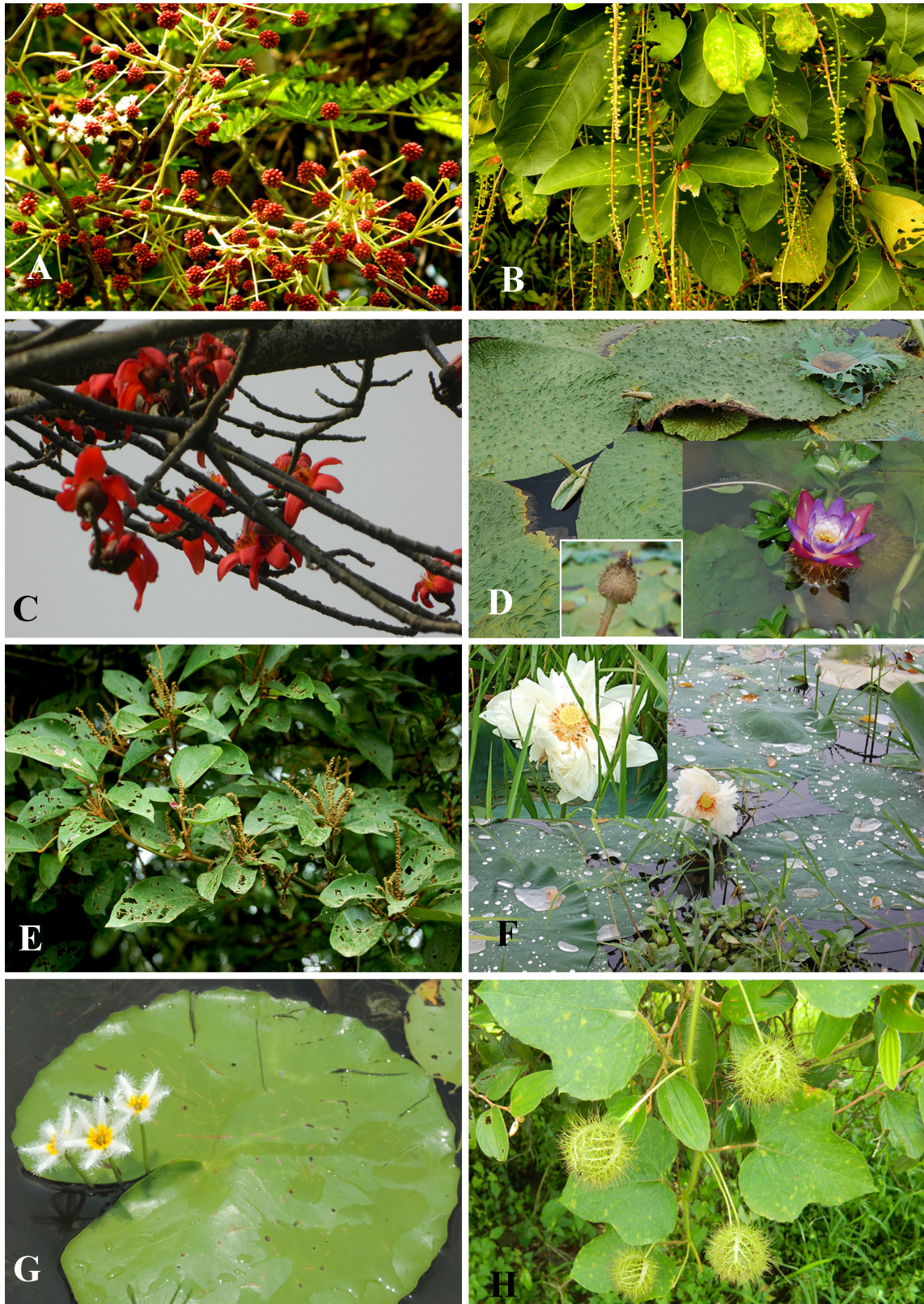


Plate 2: A. *Acacia concinna* (Willd.) DC., B. *Barringtonia acutangula* (L.) Gaertn., C. *Bombax ceiba* L., D. *Euryale ferox* Salisb, E. *Mallotus philippensis* (Lam.) Mull. Arg., F. *Nelumbo nucifera* Gaertn, G. *Nymphoides indica* (L.) Kuntze, H. *Passiflora foetida* L.



Plate 3: A. *Asparagus racemosus* Willd, B. *Commelina benghalensis* L., C. *Cyperus cephalotes* Vahl, D. *Dendrobium aphyllum* (Roxb.) C. E. C. Fisch., E. *Gastrochilus obliquus* (Lindl.) Kuntze, F. *Hydrocharis dubia* (Blume) Backer, G. *Pistia stratiotes* L., H. *Zingiber rubens* Roxb., I. *Zeuxine nervosa* (Wall. ex Lindl.) Benth. ex Trimen.

monsoon season also have a negative impact on the vegetation of the sanctuary.

Conservation measures

The sanctaury authority has taken some plantation measures in some areas of the sanctuary by planting *Albizia procera* in the fringe areas. These plantations controls the habitat loss and also lessen the degraded forest areas. Restriction to the free extraction of firewood, timber, fishing and cattle rearing inside the sanctuary curb the unnecessary interference in the natural ecosystem. Moreover, creation of awareness among the people for community participation and conservation is also given importance for efficient management of the sanctuary.

DISCUSSION

The Laokhowa wildlife sanctuary is a unique combination of grassland, wetland and different riparian forest types being a flood plain of the river Brahmaputra. Moreover,

our observation also established maximum number of herbaceous elements followed by undershrubs, shrubs and minimum number of trees. The sanctuary comprises of Indo-Malayan elements like *Antidesma acidum*, *Barringtonia acutangula*, *Cassia fistula*, etc. and some tropical American origin plants like *Argemone maxicana*, *Cassia occidentalis*, *Datura metal*, *Mimosa pudica* etc. As the plain woodland area is disturbed by annual floods, minimum numbers of trees are found growing in the sanctuary of which the dominant ones are *Albizia procera*, *Barringtonia acutangula*, *Bombax ceiba*, *Lagerstroemia speciosa*, *Streblus asper* etc. Although the sanctuary is facing threats from biotic and abiotic factors, still a few endangered (*Asplenium nidus*, *Rhynchospora hookeri*) and critically endangered (*Ceratopteris thalictroides*) species were observed (Chowdhery & al., 2005). Some rare, vulnerable (*Gastrochilus obliquus*, *Euryale ferox*) and economic plant species as mentioned were also found. Hence, the Laokhowa wildlife sanctuary apart from harbouring diverse plant

Table 4: Economic importance of some of the species of Laokhowa Wildlife Sanctuary, Assam. (ISLAM, 1990; Sharma, 2004.)

Name of the species	Family	Parts used	Uses
Plants as source of food, Beverage and spices			
<i>Amaranthus spinosus</i> , <i>A. viridis</i>	Amaranthaceae	Whole plant	Food
<i>Centella asiatica</i>	Apiaceae	Whole plant	Food
<i>Diplazium esculentum</i>	Athyriaceae	Fronds	Food
<i>Commelina benghalensis</i>	Commelinaceae	Seed	Spice
<i>Oxalis corniculata</i>	Oxalidaceae	Leaf	Food
<i>Citrus medica</i>	Rutaceae	Fruit	Beverage
<i>Piper longum</i>	Piperaceae	Fruit	Spice
<i>Ceratopteris thalictroides</i>	Parkeriaceae	Whole plant	Food
<i>Dioscorea bulbifera</i>	Dioscoreaceae	Tuber	Food
Broom yielding Plant			
<i>Sida rhombifolia</i>	Malvaceae	Whole plant	Broom
Plants as fodder			
<i>Cynodon dactylon</i> , <i>Eleusine indica</i>	Poaceae	Whole plant	Whole plant
Timber yielding plants			
<i>Alstonia scholaris</i>	Apocyanaceae	Wood	Timber
<i>Toona ciliata</i>	Meliaceae	Wood	Timber
<i>Bischofia javanica</i> , <i>Bridelia retusa</i>	Euphorbiaceae	Wood	Timber
<i>Barringtonia acutangula</i>	Lecythidaceae	Wood	Timber

<i>Lagerstroemia speciosa</i>	Lythraceae	Wood	Timber
<i>Gmelina arborea</i>	Verbenaceae	Wood	Timber
<i>Litsea glutinosa</i>	Lauraceae	Wood	Timber
Dye yielding plants			
<i>Bischofia javanica</i> , <i>Mallotus repandus</i>	Euphorbiaceae	Bark	Dye
<i>Mallotus philippensis</i>	Euphorbiaceae	Fruit	Dye
<i>Butea monosperma</i>	Fabaceae	Flower	Dye
Fibre yielding plants			
<i>Lagerstroemia speciosa</i>	Lythraceae	Bark	Fibre
<i>Bombax ceiba</i>	Bombaceae	Fruit	Fibre
<i>Sida rhombifolia</i>	Malvaceae	Stem	Fibre
<i>Melochia corchorifolia</i>	Sterculiaceae	Stem	Fibre
<i>Triumfetta rhomboidea</i>	Teliaceae	Stem	Fibre
Oil yielding plants			
<i>Celastrus paniculatus</i>	Celastraceae	Seed	Oil
<i>Tamarindus indica</i>	Caesalpiniaceae	Seed	Oil
<i>Jatropha curcas</i> , <i>Mallotus philippensis</i> , <i>Ricinus communis</i>	Euphorbiaceae	Seed	Oil
Plants as source of Medicine			
<i>Piper longum</i>	Piperaceae	Fruit	Fruit decoction to cure bronchitis.
<i>Amaranthus spinosus</i>	Amaranthaceae	Whole plant	Whole plant as health tonic.
<i>Centella asiatica</i>	Apiaceae	Whole Plant	Whole Plant as tonic.
<i>Alstonia scholaris</i>	Apocynaceae	Milky latex	Milky latex in skin diseases.
<i>Rauvolfia serpentina</i>	Apocynaceae	Root	Root extract is taken in stomach ache and hypertension.
<i>Calotropis gigantea</i>	Asclepidiaceae	Leaf	Leaf used for swelling.
<i>Ageratum conyzoides</i>	Asteraceae	Leaf	Leaf used as antiseptic.
<i>Eclipta prostrata</i>	Asteraceae	Whole plant	Whole plant for Jaundice/ Liver trouble.
<i>Oroxylum indicum</i>	Bignoniaceae	Tender leaf and bark	Tender leaf and bark decoction is taken in dysentery.
<i>Cassia fistula</i>	Caesalpiniaceae	Pods	Pods are used as purgative.
<i>Cannabis sativa</i>	Cannabaceae	Leaf	Leaf for Gonorrhea.
<i>Commelina bengalensis</i>	Commelinaceae	Leaf	Leaf as abdominal pain.
<i>Cuscuta reflexa</i>	Cuscutaceae	Whole plant	Whole plant to cure disc pro- lapsed of waist.
<i>Kyllinga brevifolia</i>	Cyperaceae	Rhizome	Rhizome for rheumatic pain.
<i>Euphorbia hirta</i>	Euphorbiaceae	Leaf	Leaf for skin infection.
<i>Sida rhombifolia</i>	Malvaceae	Root	Root used as antiseptic.
<i>Boerhavia diffusa</i>	Nyctaginaceae	Leaf	Leaf extract to cure eye disease.

<i>Oxalis corniculata</i>	Oxalidaceae	Whole plant	Whole plant as abdominal pain.
<i>Solanum americanum</i>	Solanaceae	Fruit	Fruit as abdominal pain.
<i>Cheilocostus speciosus</i>	Zingiberaceae	Rhizome	Rhizome for rheumatic pain.

communities also support wild animals, birds, insects and fishes which is essential in sustaining the biodiversity.

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